Mycotic aneurysms of the thoracic and abdominal aorta and iliac arteries: Experience with anatomic and extra-anatomic repair in 33 cases

Barbara Theresia Müller, MD,[a] Otto Ruano Wegener, MD,[a] Klaus Grabitz, MD,[a] Michael Pillny, MD,[a] Lutz Thomas, MD,[b] and **Wilhelm Sandmann, MD,[a]** *Düsseldorf, Germany*

Objective: **A mycotic aneurysm of the aorta and adjacent arteries is a dreadful condition, threatening life, organs, and limbs. With regard to the aortic segment involved, repair by either in situ replacement or extra-anatomic reconstruction can be quite challenging. Even when surgery has been successful, the prognosis is described as very poor because of the weakened health status of the patient who has developed this type of aneurysm. The aim of our study was to find out whether any progress could be achieved in a single center over a long time period (18 years) through use of surgical techniques and antiseptic adjuncts.**

Material and Methods: **From January 1983 to December 1999, a total of 2520 patients with aneurysms of the thoracic and abdominal aorta and iliac arteries underwent surgery for aortic or iliac replacement at our institution. During that period, 33 (1.31%) of these patients (mean age, 64.3 years) were treated for mycotic aneurysms of the lower descending and thoracoabdominal (n = 13), suprarenal (n = 4), and infrarenal (n = 10) aorta and iliac arteries (n = 6). Twenty (61%) of these 33 patients had histories of various septic diseases; in the other 13 (39%), the etiology remained uncertain. Preoperative signs of infection, such as leukocytosis and elevated C-reactive protein, were found in 79% of the patients, and fever was apparent in 48%; 76% of the patients complained of pain. At the time of surgery, eight (24%) mycotic aneurysms were already ruptured, and 20 (61%) had penetrated into the periaortic tissues, forming a contained rupture. Five (15%) aneurysms were completely intact. The predominant microorganisms found in the aneurysm sac were *Staphylococcus aureus* and *Salmonella* species. Careful debridement of all infected tissue was essential. In the infrarenal aortic and iliac vascular bed, in situ reconstruction was performed only in cases of anticipated "low-grade" infection. Alternative revascularization with extra-anatomic procedures (axillobifemoral or femorofemoral crossover bypass graft) was carried out in eight of 16 cases. All four suprarenal and all 13 mycotic aneurysms of the thoracoabdominal aortic segment were repaired in situ. Antibiotics were administered perioperatively, and all patients were subsequently treated with long-term antibiotics.**

Results: **In-hospital mortality was 36% (n = 12). Because of the smallness and heterogeneity of the sample, we could not demonstrate significant evidence for any influence of aneurysm location or type of reconstruction on patients' outcome. However, survival was clearly influenced by the status of rupture. During long-term follow-up (mean, 30 months; range, 1-139 months), 10 patients (48%) died—one (4.8%) probably as a consequence of the mycotic aneurysm, the others for unrelated reasons. Eleven patients (52%) are alive and well today, with no signs of persistent or recurrent infection.**

Conclusions: **A mycotic aneurysm of the aortic iliac region remains a life-threatening condition, especially if the aneurysm has already ruptured by the time of surgery. Although the content of the aneurysm sac is considered septic, as was proved by positive cultures in 85% of our patients, in situ reconstruction is feasible and, surprisingly, was not more closely related to higher morbidity and mortality in our series than ligation and extra-anatomic reconstruction, although most of the aneurysms repaired in situ were located at the suprarenal and thoracoabdominal aorta. We assume that our operative mortality rate of 36%, which relates to a rupture rate of 85%, could be substantially lowered if the diagnosis of mycotic aneurysm were established before rupture. (J Vasc Surg 2001;33:106-13.)**

The misleading term *mycotic* was introduced by William Osler[1] in 1885 as part of a description of a 30-year-old man who was dying after a period of diarrhea, chills, headache, cough, and fever. The autopsy revealed a destroyed aortic valve with extensive vegetations, and in the aortic arch there were four aneurysms that had developed as complications of endocarditis. The largest aneurysm, presenting a condition of mycotic endarteritis, had perforated the aneurysmal sac and caused a rupture into the pericardium.

Nowadays, most authors use the term *mycotic aneurysm* in a broader sense to describe any kind of infected aneurysm, regardless of its pathogenesis. Such aneurysms may result from bacteremia and embolization of infectious material, which cause superinfection of a diseased and roughened atherosclerotic surface.[2-6] Rarely, bacteria may also colonize the intact vascular wall through the vasa vasorum[2,5-7]; the localized suppurative process

From the Department of Vascular Surgery and Kidney Transplantation[a] and the Institute for Medical Microbiology and Virology, Heinrich-Heine University.[b]

Competition of interest: nil.

Reprint requests: Barbara Theresia Müller, MD, Department of Vascular Surgery and Kidney Transplantation, Heinrich-Heine University Düsseldorf, Moorenstr. 5, D 40225 Düsseldorf, Germany (e-mail: Weis.Mueller@t-online.de).

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weakens the arterial wall and allows formation of an aneurysm. Alternatively, an extravascular infectious focus, such as vertebral osteomyelitis, may penetrate directly or through the lymphatic tissue into an adjacent vascular structure, leading to necrosis, bleeding, and formation of a pseudoaneurysm.[7-9]

A painful, rapidly growing aneurysm, often already ruptured at the time of operation, together with a history of fever, leukocytosis, and positive blood cultures,[6] is very suggestive of a mycotic aneurysm and should not be confused with an asymptomatic aneurysm, in which bacteria are found accidentally.[10] It has been reported that cultures of the abdominal aortic aneurysm content, routinely taken during surgery, were positive in up to 15% of cases, and even in the aortic wall itself, antigens of such organisms as *Chlamydia pneumoniae* could be demonstrated by means of immunohistochemistry.[11-13] However, in the absence of any clinical signs of infection, these findings do not justify a diagnosis of mycotic aneurysm.

This report is concerned with a review of the senior author's (W.S.) experience in the surgical treatment of 33 patients with mycotic aneurysms of the descending aorta and the iliac region.

PATIENTS AND METHODS

From January 4, 1983, to December 12, 1999, we treated 33 patients with a mycotic aortic or iliac aneurysm at our institution. Analysis of the group was prospective in 13 cases and retrospective in 20 cases. The group consisted of eight women and 25 men with a mean age of 64.3 years (range, 48.4-77.3 years). The diagnosis of mycotic aneurysm was accepted if (1) the aneurysm was associated with a positive culture from the aneurysmal wall, its content, or the surrounding tissue and (2) the patient displayed signs of an associated infection. Aneurysms with sterile cultures were considered "mycotic" only if (1) they intraoperatively displayed the typical aspect of an eccentric and perforated or penetrated aneurysm, (2) the patient had signs of infection, and (3) the patient had been treated with antibiotics before surgery. All medical and surgical records and imaging studies were reviewed.

Follow-up after a mean of 30 months (range, 1-139 months) consisted of abdominal and/or thoracic computed tomography (CT) and laboratory examinations, such as blood count and C-reactive protein (CRP). Information about the patients who had died in the meantime was drawn from autopsy reports, official death certificates, and interviews with the patients' physicians or relatives.

Etiology. Etiology was unknown in 13 (39%) patients. Fourteen (42%) patients had histories of various septic diseases, including spondylodiskitis (n = 2), previous colectomy with anastomosis dehiscence and peritonitis (n = 1), esophagus perforation with mediastinitis (n = 1), pneumonia (n = 1), previous intramuscular injection causing various abcesses in different sites (n = 1), and pancreatitis (n = 1). One patient had had an infrarenal mycotic aneurysm and had been treated by in situ reconstruction in another hospital; 8 months later, he had a new mycotic aortic aneurysm at the thoracoabdominal transition zone without infection of the prosthesis. Three patients had undergone previous aortoarteriography, two patients had had a previous autogeneous revascularization in another anatomic region, and one patient had been nephrectomized within the past 6 months. Six patients (18%) had presented with *Salmonella* species in their preoperative blood cultures or intraoperative specimens; in these cases, the modus of the infection remained unclear (Table I). Analysis of the associated conditions revealed that each of five patients (15%) had malignant disease (leukemia or lymphoma, n = 3; colon cancer, n = 1; prostate cancer, n = 1), and two others were taking long-term corticoid medication because of rheumatism (n = 2), which indicated depressed immunocompetence. Eight patients had diabetes mellitus.

Symptoms and clinical and radiologic findings. Twenty-six (79%) patients demonstrated preoperative signs of infection, such as leukocytosis and elevated CRP, whereas only 16 patients (48%) had elevated temperature. In each of eight patients (24%), a preoperative blood culture was taken and found to be positive. Interestingly, most of the aneurysms were symptomatic; 25 patients (76%) complained of severe back, abdominal, or thoracic pain, depending on the location of the aneurysm. In addition, four patients with mycotic thoracoabdominal aortic aneurysm had respiratory insufficiency, and two of these had to be intubated and ventilated before surgery. In three patients, kidney function deteriorated preoperatively (one patient required hemodialysis). One patient had acute right heart failure because of a mycotic fistula between the aorta and the inferior vena cava.

Because of hemorrhagic (n = 3) or septic (n = 1) shock, four patients underwent surgery immediately after admission; there had been no previous investigations in these cases. CT scanning was performed in 27 cases and magnetic resonance imaging (MRI) in two cases. Signs of rupture or penetration were seen in CT or MRI scans in 24 cases, whereas each of six scans revealed a rapidly enlarging aneurysm since the previous investigation (Fig 1). Two CT scans displayed a soft tissue mass around the aorta, and one scan displayed a fistula between the aorta and the inferior vena cava. An eccentrically configured aortic aneurysm was the only sign in one CT scan. One angiography demonstrated a saccular aneurysm.

Bacteriology. Cultures from specimens of aneurysmal content, the arterial wall, or the surrounding tissue were obtained from 30 patients (Table I). In three patients, intraoperative bacteriologic investigation was not performed, but blood cultures taken before surgery had shown *Salmonella* species in two cases and *Staphylococcus aureus* in one case. In eight patients (24%), cultures were negative, probably because antibiotics had been given for some time. All eight of these patients had preoperative signs of infection, and in three patients blood cultures taken before surgery had shown microorganisms (*Salmonella*, n = 1; *S aureus*, n = 1; *Escherichia coli*, n = 1). Gram-positive organisms predominated, *S aureus* being

Table I. Bacteriology and probable etiology of mycotic aneurysm

Bacteria cultured from IO specimens	*No. of specimens (n = 36)*	*(%)*	*No. of specimens Probable etiology*	*(n = 36)*
Staphylococcus aureus	6+	(22)	Aortoarteriography	2
No IO specimen, blood culture positive*	1		Intervertebral discitis	1
IO specimen negative, blood culture positive†	1		Previous vascular reconstruction	1
			Intramuscular injection	1
			Unknown	3
Staphylococcus epidermidis‡	3	(8)	Aortoarteriography	1
			Unknown	2
Enterococcus species‡	4	(11)	Colon cancer, dehiscence, and peritonitis	1
			Esophagus perforation and mediastinitis	1
			Unknown	2
Streptococcus species‡	4	(11)	Previous vascular reconstruction	1
			Unknown	3
Salmonella species	3+	(17)	Unknown	6
No IO specimen, blood culture positive*	2			
IO specimen negative, blood culture positive†	1			
Escherichia coli‡	2	(9)	Colon cancer, dehiscence, and peritonitis	1
IO specimen negative, blood culture positive†	1		Unknown	2
Bacteroides species	2	(5.5)	Previous nephrectomy	1
			Unknown	1
Aspergillus	1	(3)	Pneumonia	1
IO specimen sterile (no blood culture)	5	(14)	Pancreatitis	1
No blood culture			Intervertebral discitis	1
			Unknown	3

IO, Intraoperative.
*In three cases, no IO culture was taken but preoperative blood cultures had revealed an organism.
†Three patients had sterile IO cultures and had shown microorganisms in blood culture.
‡In three IO specimens, two different organisms were observed.

Table II. Location of mycotic aneurysm

Location	*No. of patients*	*%*
Iliac artery	6	18.2
Aorta abdominal	14	42.4
Infrarenal	10	
Suprarenal	4	
Aorta thoracoabdominal	13	39.4
TAA I	4	
TAA II	1	
TAA III	1	
TAA IV	7	

the most common. *Salmonella* species were seen in three intraoperative cultures and also in three blood cultures. Only four of the intraoperative specimens yielded, in addition to *Salmonella*, gram-negative organisms such as *E coli* and *Bacteroides* species. *Aspergillus* could be demonstrated in one specimen. Three cultures revealed bacterial growth of two different organisms (*E coli* combined with *Enterococcus* and *Streptococcus* together with *Staphylococcus epidermidis*).

Anatomic location. The mycotic aneurysms in our material occurred in all parts of the descending aorta and the iliac arteries (Table II). The iliac arteries were affected in six cases and the infrarenal aorta in 10 cases. Each of four patients had a suprarenal mycotic aneurysm and could be treated through use of a transperitoneal approach. Each of seven patients had a mycotic aneurysm of the thoracoabdominal transition zone (TAA IV) and required a thoracolaparotomy (Fig 2). The thoracic descending aorta alone (TAA I) was concerned in four cases, and two other cases were thoracoabdominal aneurysms of type II and type III (Crawford's classification).[14]

Eight (24%) of the mycotic aneurysms had already ruptured at time of surgery. Free rupture and shock were present in 3 patients with iliac aneurysms, whereas 2 infrarenal mycotic aortic aneurysms had ruptured into the retroperitoneum, 1 infrarenal mycotic aneurysm had ruptured into the inferior vena cava and caused a significant shunt, 1 thoracic aneurysm had perforated into a bronchus, and 1 thoracic aneurysm had perforated into the lung. Chronic- contained rupture and penetration into the periaortic tissues were observed in 20 cases (61%). Only five mycotic aneurysms (15%) were still intact at time of surgery and had not perforated or penetrated (Table III).

Choice of surgical procedure. In the infrarenal aorta and iliac arteries, revascularization was performed either by in situ reconstruction or by extra-anatomic procedures (Table IV). In general, the indication for extra-anatomic revascularization was a severe infection with pus in the aneurysmal cavity or with purulent periaortic tissue, whereas in situ reconstruction was performed in case of low-grade infection (pseudoaneurysm, absence of pus). However, all suprarenal and thoracoabdominal mycotic abdominal

Fig 1. Progression of mycotic suprarenal aortic aneurysm during 1 month.

aneurysms were reconstructed in situ because of the difficult anatomic region and the necessity of simultaneous revascularization of intercostal, visceral, and renal arteries.

Revascularization was achieved by either axillo-bifemoral (n = 7) or femorofemoral (n = 1) bypass graft in eight (50%) of 16 mycotic aneurysms of the infrarenal aortic and iliac circulation. All 17 patients with mycotic aneurysms in suprarenal or thoracoabdominal locations were treated in situ either with patch plasty or with tube graft (both consisting of warp-knitted, double velour polyester impregnated with absorbable modified gelatin). Visceral or renal arteries had to be reimplanted in nine patients. Rigorous debridement of all infected tissue was carried out, and healing was supported by an omental pedicle when this was technically possible. All in situ replaced grafts were soaked with rifampin and covered with gentamicin-soaked gauze. Antibiotics were administered perioperatively and postoperatively. All patients were given long-term treatment with specific antibiotics according to sensitivity studies.

RESULTS

Statistical analysis. Because of the lack of power in the sample (n = 33) and the retrospective nature of the survey in most patients, a meaningful statistical analysis was not possible. The multitude of factors that might influence outcome (eg, anatomic location, surgical treatment, status of rupture, and bacteriology) would necessitate a much greater number of cases than were available for this series, which is already one of the largest published to date. For demonstrating late survival results, a cumulative Kaplan-Meier analysis was used.

Early results. Of the 2520 patients treated at our institution for thoracic and abdominal aortic and iliac aneurysms during the past 18 years, 33 (1.31%) had mycotic aneurysms. In-hospital mortality for this condition was 36% (n = 12; Table IV). Twelve patients died a mean of 12.4 days (range, 0-40 days) after surgery; one patient died of cardiac failure during surgery. One patient died 9 days after surgery for cardiac reasons; 1 patient succumbed to hypovolemic shock; 2 patients died because of respiratory failure, 4 because of sepsis, and 3 because of multiorgan failure due to sepsis.

Despite the statistical shortcomings of this series, some of the results are intuitively convincing. Survival was clearly dependent on the state of rupture (Table III). All 5 patients with intact mycotic aneurysms survived the perioperative period, whereas 5 (63%) of 8 patients with aneurysm rupture and 7 (35%) of 20 patients with contained rupture forming a pseudoaneurysm died in the hospital. In our small sample, outcome did not depend on the anatomic location of the mycotic aneurysm; mortality ranged from 33% (iliac aneurysms) to 38% (thoracoabdominal aneurysms; Table IV). The influence of type of surgical management on early outcome is not quite clear. Four (50%) of eight of the extra-anatomically reconstructed patients died; this compared with eight (32%) of the 25 patients with in situ revascularization.

Each of three patients with a type IV mycotic thoracoabdominal aneurysm had a mild paraparesis that resolved

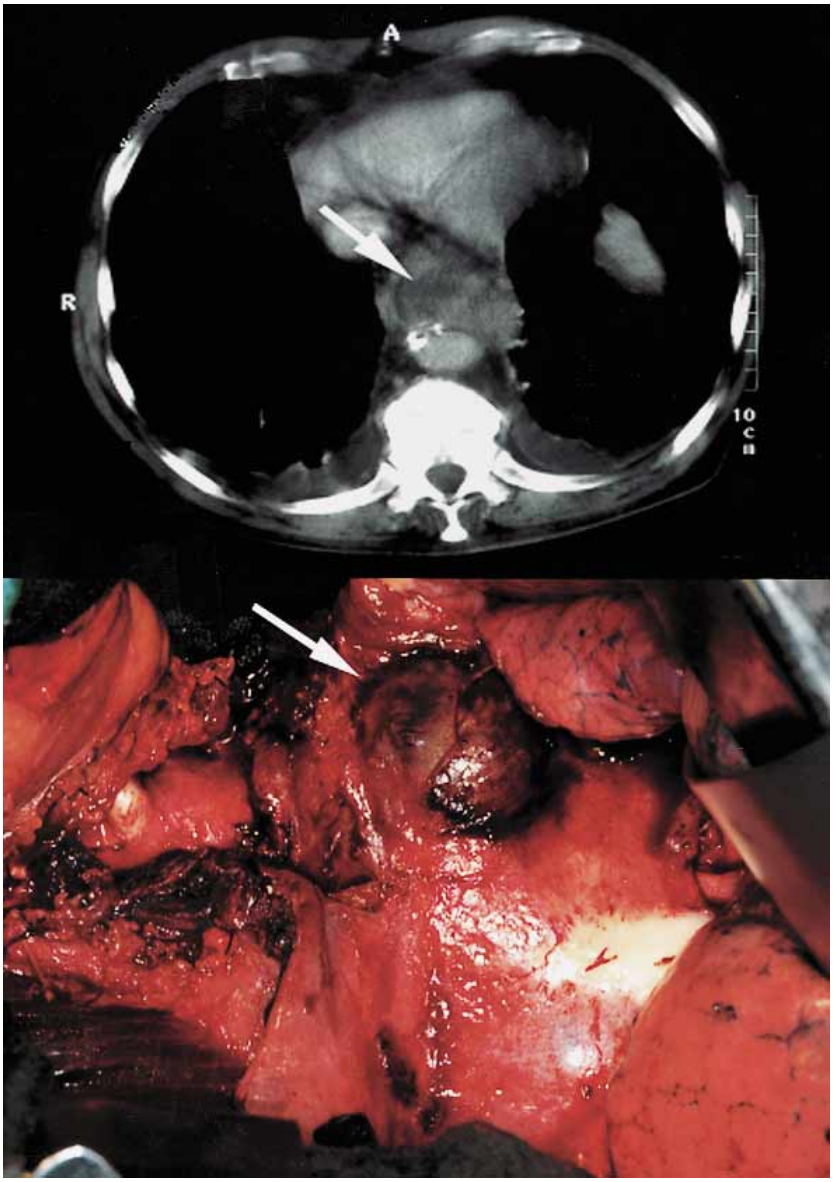

Fig 2. Mycotic aortic aneurysm of thoracoabdominal region.

Table III. Number of perioperative deaths in relation to status of perforation

Status of perforation	*No. of patients (%)*	*No. of perioperative deaths (%)*
Rupture	8 (24)	5 (63)
Free	3	2
Into retroperitoneum	2	2
Into other organs	3	1
Contained rupture (pseudoaneurysmal)	20 (61)	7 (35)
Intact	5 (15)	0 (0)
Totals	33 (100)	12 (36)

within 1 year. One patient had thoracic bleeding, which was treated successfully. One patient with salmonellosis had a psoas muscle abscess in addition to his mycotic infrarenal aortic aneurysm; he was reconstructed in situ. Postoperative CT scans revealed that the psoas muscle abscess persisted without any signs of prosthetic infection. The abscess was successfully drained through use of CT-guided methods and disappeared within 1 week. CT scans taken 1 month after removal of the drain did not show any signs of abscess recurrence. Two other patients displayed some liquid around the prosthesis after in situ reconstruction of the mycotic aneurysm. Interventional drain lavage and microbiologic analysis revealed that the periprosthetic liquid was

Table IV. Location of mycotic aneurysm, surgical management, and relation to perioperative mortality

Location	*All patients/ No. of peri-operative deaths*	*Mortality (%)*	*Extra-anatomic/ No. of peri-operative deaths*	*Mortality (%)*	*In situ*			
					Tubular graft/ No. of peri-operative deaths	*Mortality (%)*	*Patch/ No. of peri-operative deaths*	*Mortality (%)*
Iliac artery	6/2	33	3/2	67	3/0	0	—	—
Aorta: abdominal	14/5	36	5/2	40	9/3	33	—	—
Infrarenal	10/5	50	5/2	40	5/3	60	—	—
Suprarenal*	4/0	0	—	—	4/0	0	—	—
Aorta: thoracoabdominal†	13/5	38	—	—	9/3	33	4/2	50
TAA IV*	7/1	14	—	—	5/0	0	2/1	50
TAA III	1/0	0	—	—	—	—	1/0	0
TAA II*	1/1	100	—	—	1/1	100	—	—
TAA I	4/3	75	—	—	3/2	67	1/1	100
Subtotals	—	—	—	—	21/6	29	4/2	50
Totals	33/12	(36%)	8/4	(50%)	25/8		(32%)	

*In nine cases, visceral and/or renal arteries had to be reimplanted.
†Crawford classification.

sterile, and CT scans taken 6 weeks after removal of the drain showed no evidence of prosthetic infection.

Late results. Complete follow-up of all 21 (100%) surviving patients at a mean of 30 months (range, 1-139 months) was achieved. At a follow-up of 47 months (range, 2-139 months), 10 patients (48%) had died. One patient with a history of colectomy for tumor, anastomotic dehiscence, peritonitis, and mycotic iliac aneurysm had undergone in situ reconstruction and died 2 months later; autopsy revealed a persistent peritonitis and liver metastasis. The other nine patients died of unrelated causes, such as cardiac problems (n = 4), cancer (n = 2), stroke (n = 1), subarachnoidal bleeding (n = 1), and gastrointestinal bleeding resulting from pancreatitis (n = 1). For the cumulative survival rate, a Kaplan-Meier survival analysis was done (Fig 3).

Follow-up of the 11 survivors was achieved up to a mean of 15 months (range, 1-67 months). One patient in poor health who had required intubation and dialysis before surgery had a type IV mycotic thoracoabdominal aneurysm and was reconstructed urgently with a Dacron patch. CT scanning done postoperatively and 12 months later showed a second, probably mycotic aneurysm distal to the patch in the infrarenal region. Reoperation, this time through use of the transperitoneal approach, was performed successfully 15 months after the first operation. The aneurysm had penetrated into the right retroperitoneum and had not been detected during the first reconstruction through the thoracoabdominal approach. The other 10 patients are well, without any signs of infection.

DISCUSSION

Although mycotic aneurysms have been reported in all age groups, including newborns, the typical patient is elderly and atherosclerotic.[6,15,16] In our study, the mean age of the patients, 64 years, was comparable to that for all of the other patients who underwent aneurysm surgery at our institution.[17]

Over the past 30 years, there has been a change in the etiology of mycotic aneurysms.[9] Since the introduction of antibiotics, endocarditis as a source of bacteremia has become rare, and several risk factors for mycotic aneurysm, especially in older patients, are currently more common. As seen in our study, these include diagnostic or therapeutic arterial catheterization, previous operations in distant sites, and depressed immunocompetence secondary to (1) chronic or neoplastic diseases and (2) administration of corticoid or cytotoxic agents.[18,19] In accord with the findings in several other reports,[3,4,9] *S aureus* and *Salmonella* species were the most common organisms cultured from our intraoperative specimens. Microorganisms often lodge in the intimal layer of a diseased vascular segment. A predilection for congenitally abnormal (eg, coarctation) or atherosclerotic segments has been described.[4,5] We could not recognize any predilection zone in the aortoiliac vascular bed, but as previously described by Chan et al,[4] mycotic aneurysms in the visceral segment of the thoracolumbar aorta were common, perhaps because the atherosclerotic destruction can be very prominent in this region.

In comparison with noninfected aortic aneurysms, mycotic aneurysms are "symptomatic," and 76% of our patients complained of abdominal, back, or thoracic pain. Forty-eight percent of the patients had fever, and 79% had laboratory changes indicating infection. These findings, together with CT signs such as a rapidly growing or newly developed aneurysm, air in the aortic wall, a leakage of aortic contrast material, a saccular aneurysm, or a soft tissue mass surrounding the nondilatated or aneurysmal aorta (often accompanied by a broken calcified atherosclerotic aortic plaque[3,5,20-22]), are suggestive of an infected aneurysm, and early operative intervention is indicated.

In the past 30 years, ever since Bennett and Cherry[23] reported that infected aneurysms of the abdominal aorta were invariably fatal, possibilities for surgical and medical

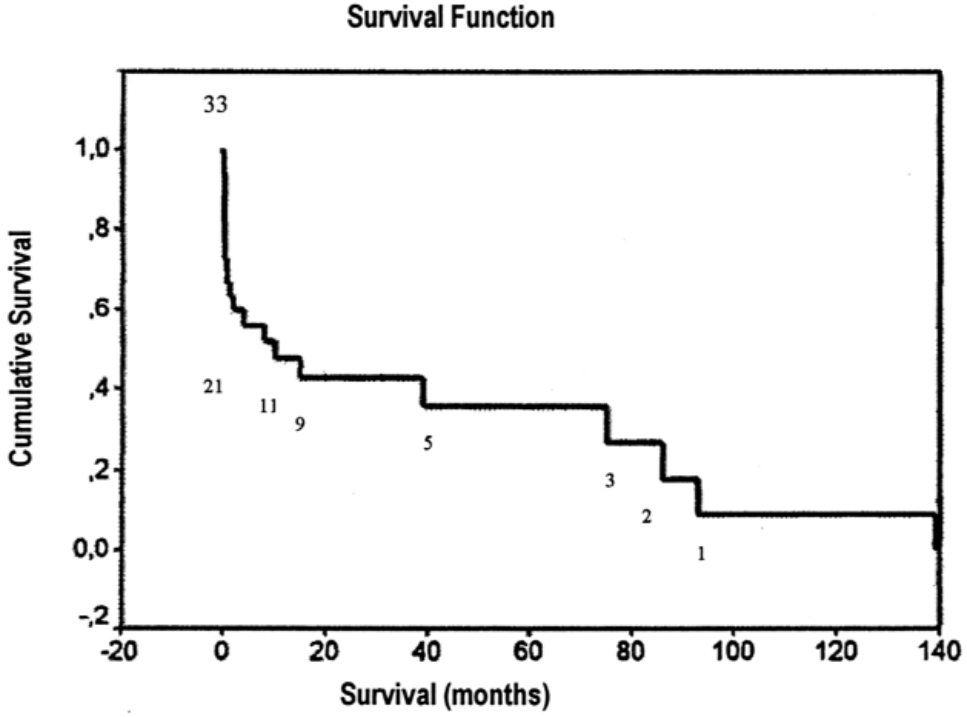

Fig 3. Kaplan-Meier survival analysis.

treatment have improved. Nevertheless, the optimal management of infected aneurysms remains controversial. For the infrarenal aorta and iliac arteries, ligation of the aorta and extra-anatomic bypass graft has been considered the standard treatment for aortic sepsis to avoid the use of grafts in a contaminated region.[23,24] Despite lifelong anticoagulation, however, patency rates for long axillobifemoral bypass grafts are poor, and aortic stump bleeding has been reported.[3,25,26] When the mycotic process involves the visceral aortic segment, the infected region cannot be avoided and in situ reconstruction with reimplantation of visceral or renal arteries may be less hazardous than extra-anatomic reconstruction.[4,24,33-35] This maneuver must be combined with an accurate debridement of all infected tissue, and the reconstruction should be covered with an omental flap if this is technically possible.

It is recommended that in situ replaced grafts be soaked with rifampin,[28-32] which has a considerable antistaphylococcal activity and has already been shown to bind significantly to gelatin-sealed Dacron grafts. Furthermore, the intraoperative application of gentamicin-releasing carriers has been reported,[36] and we regularly use gentamicin-soaked gauze to tamponade the pseudoaneurysmatic cavity. As an alternative to tubular graft replacement, a Dacron patch angioplasty can be performed if the lesion is well circumscribed and the adjacent aorta is not dilatated.[4,24]

Our applied surgical technique varied according to the anatomic location of the mycotic aneurysm and the severity of its infection. In the infrarenal vascular bed, in situ reconstruction was performed in cases of low-grade infection if the inflammatory process was circumscribed and pus was absent. If a severe purulent infection was seen, extra-anatomic bypass graft was considered, and this was performed in one half of our infrarenal mycotic aortic and iliac aneurysms. In the suprarenal and thoracoabdominal region, in situ revascularization was carried out in each patient by means of either a tube graft or a patch angioplasty. Because of the smallness of the sample, our study could not detect any statistical significance as regards the extent to which different surgical procedures influenced patient outcome. The mortality was higher in the "extra-anatomic revascularization" group in our sample, but these patients probably had undergone a negative selection because of the decision to use extra-anatomic procedures in cases of severe infection. Outcomes for our patients were worse when the aneurysm had already ruptured or penetrated and formed a pseudoaneurysm. This supports the hypothesis that early diagnosis and timely operation might be the most important factors in the survival of patients with aortic sepsis.[3,37] In any case of unclear or persistent sepsis, especially in a young drug user or an elderly patient with depressed immunocompetence (diabetes mellitus, previous malignant disease, corticosteroid medication), a diagnosis of mycotic aneurysm should be considered, and thoracoabdominal CT scans should be performed in a timely manner.

Intensive antibiotic therapy is crucial for successful treatment and should be started perioperatively; a broad-

spectrum antibiotic should be used until culture sensitivity reports are available and a specific antibiotic is determined.[28] The required duration of antibiotic therapy is not well established; recommendations range from 6-8 weeks to lifelong.[4,9,28] In our opinion, postoperative antibiotics should be administered for at least 3 months and should be discontinued only when careful examination of the patient reveals no further signs of infection. Regular controls with CT scans and control of infection parameters, such as CRP, are necessary, because recurrent or persistent aortic or graft infections might occur.[4,10,28] In our own sample, postoperative CT scans revealed one persistent abscess of the psoas muscle without any signs of prosthetic infection; this was successfully treated with interventional drainage and lavage. In postoperative CT scans, each of two additional patients displayed a persistent periprosthetic liquid in the former aneurysmal sac. Diagnostic interventional drainage of the liquid was therefore performed; fortunately, this did not show any evidence of prosthetic infection later on.

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